Final Report on

**Board Game using Artificial Intelligence**

*Submitted by-*

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**About**

Brain teasing games have been always very fascinating games from many years, starting from chess, puzzles, crossword, Jigsaw, maze, crossword, knight’s tour, mechanical puzzles and many more. Tiger Goat trap game and Sudoku are among them.

Tiger trap game requires strategic approach while, Sudoku requires high computational power. It keeps you practicing your logical thinking process when you are solving a puzzle, and eventually improve your, strategic and number skills, sense of time and makes you a better decision maker. In this project two such games are introduced. Among them, one is Sudoku and other one is Goats and Tiger (Tiger trap), which require logical thinking.

The inspiration to design Tiger Goat Trap game came from the villages of Uttarakhand, where people used to play it on the ground by making the triangular structure by chalk and stones in place of tiger and goats. This game can be now played with intelligent tiger with this project. Similarly, Sudoku is a game which people are playing since ages.

**Introduction**

**WORK DISTRIBUTION**

Due to quarantine period, both have individually developed two different board games. Tiger Goat Trap game has been developed by Saurav Singh Selakoti individually while, Venkatesh has developed Sudoku Solver.

Tiger Goat Trap Game

Strategy, Algorithm and Code for Tiger Trap Game has been done by **Saurav**. It includes Designing strategy, Algorithm and developing code for Tiger Trap game.

Sudoku

The graphical User Interface (GUI), solution for sudoku part is done by **Venkatesh**. It includes designing interface for sudoku and reaching to solution set for given problem set in Sudoku game using algorithm.

**IMPLEMENTATION**

Tiger Goat Trap Game

Tiger Goat trap game is strategic game which is usually played in some regions of Uttarakhand and other parts of India with different names.

It is multiplayer game in which there is board of triangular shape. One player plays as tiger and another player plays as 3 goats. The board has total 10 number of positions (nodes) to move. A goat and tiger can move to their neighbour node only if it is empty. But in case of Tiger it can jump up to two nodes only if tiger’s killing move is possible.

So, using these set of rules an AI tiger has been introduced which will be able to compete with human intelligence. This AI tiger uses Best First Search as well as Hill-Climbing Algorithms to decide best possible move.

Set of rules

1. A tiger or goat can move only to their neighbour node. But tiger’s killing move is exception in which he can jump up to two nodes.
2. For killing move these all 4 conditions must satisfy-
   1. Tiger’s next node is occupied by any goat
   2. Goat’s neighbour node is empty
   3. All 3 nodes (tiger’s position, goat’s position, neighbour of goat) are linear.
   4. Tiger has at least one neighbour node which is empty
3. If tiger is able to kill at least two goats then tiger is declared as winner
4. If all neighbour nodes of tiger are occupied by goats then goats are declared as winner.
5. Tiger can move to only 7 locations from 10, while goats can move anywhere.

How Tiger decides his move

Tiger can lose the game if and only if all his surrounding nodes are occupied by goats. So, tiger avoids that node which is surrounded by the greatest number of goats, in such manner he avoids losing and forces goats to come one by one to his territory. And when any goat is going to be killed, it selects that move.

Classification of Tiger Goat game based on

Problem Characteristics

1. Is problem decomposable or not?

This game can’t be decomposed further unlike Integration problems.

1. Can a solution step be Ignored, recovered or it is irrecoverable?

Tiger Goat Trap Game can’t recover its moves once it is committed by tiger or Goats. It is irrecoverable. And no step can’t be ignored as each move decides what is going to be the next move of other user.

1. Is problem universe predictable?

As it is 2 player game, so its unpredictable; the universe of this game can be predicted.

1. Is a solution good solution, absolute or relative?

In this case the solution is always relative due to its unpredictable moves. The solution may be in favour of either tiger or goat at any position.

1. Is this Solution a state or path?

Tiger goat game has fixed number of nodes where tiger and goat can move. The solution of this problem is a state where either tiger has no possible moves or there is only one goat left.

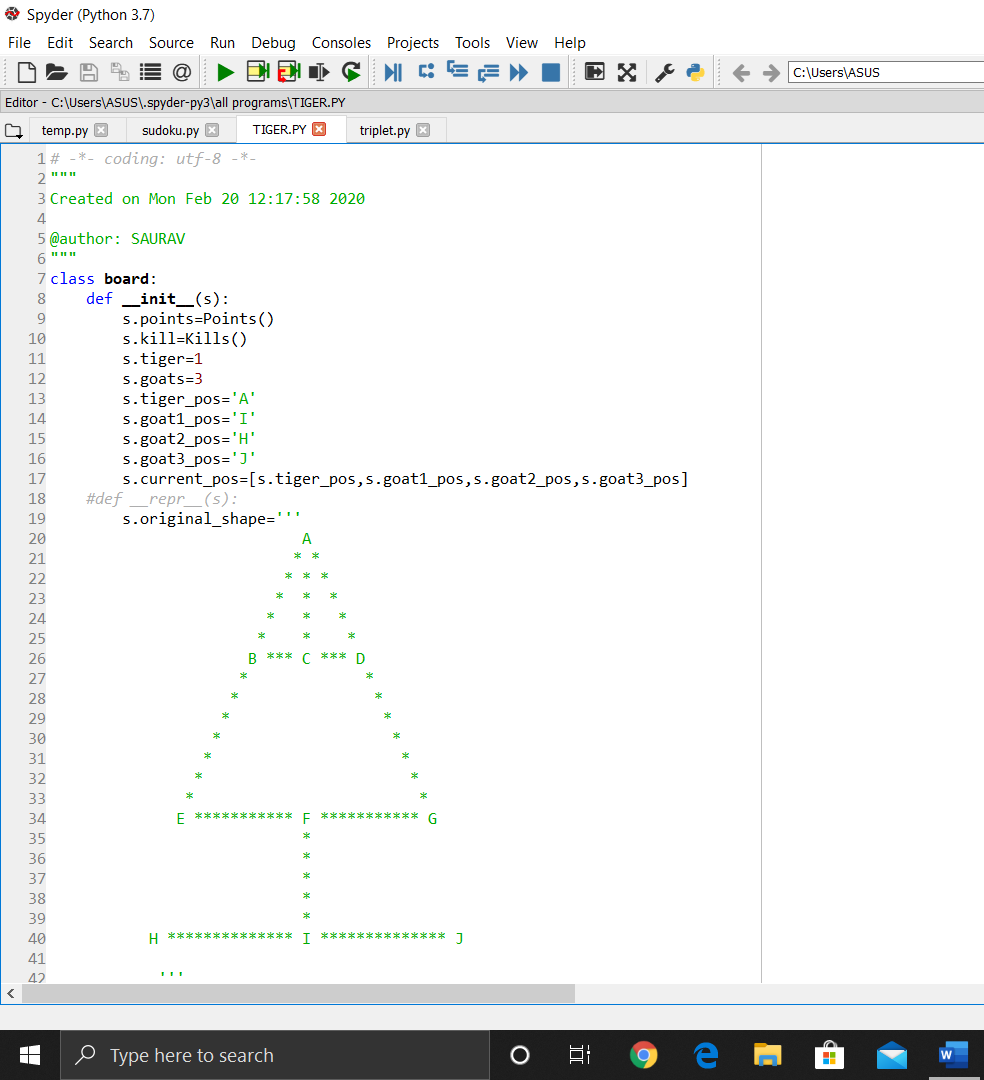
1. What is role of knowledge?

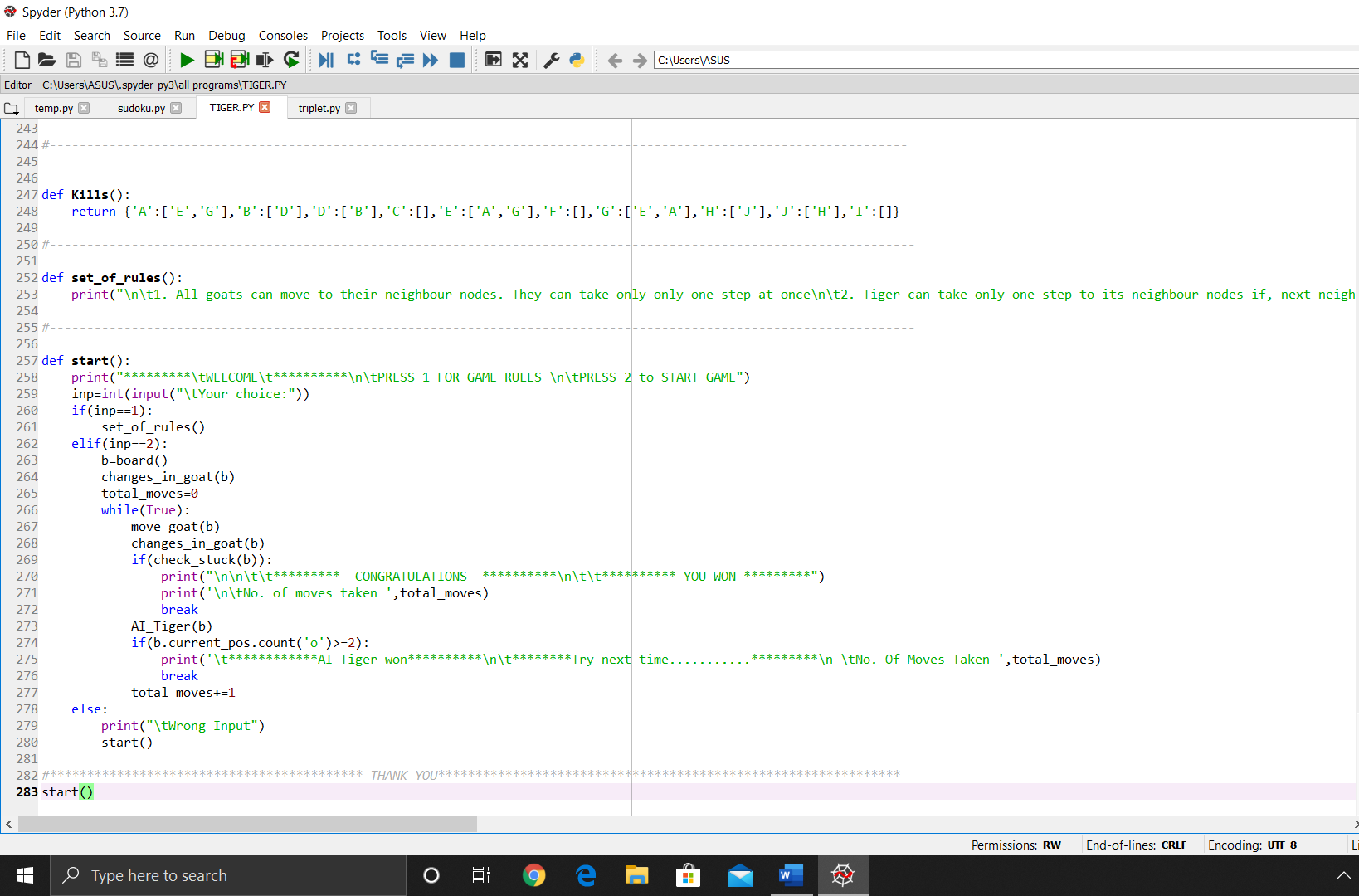
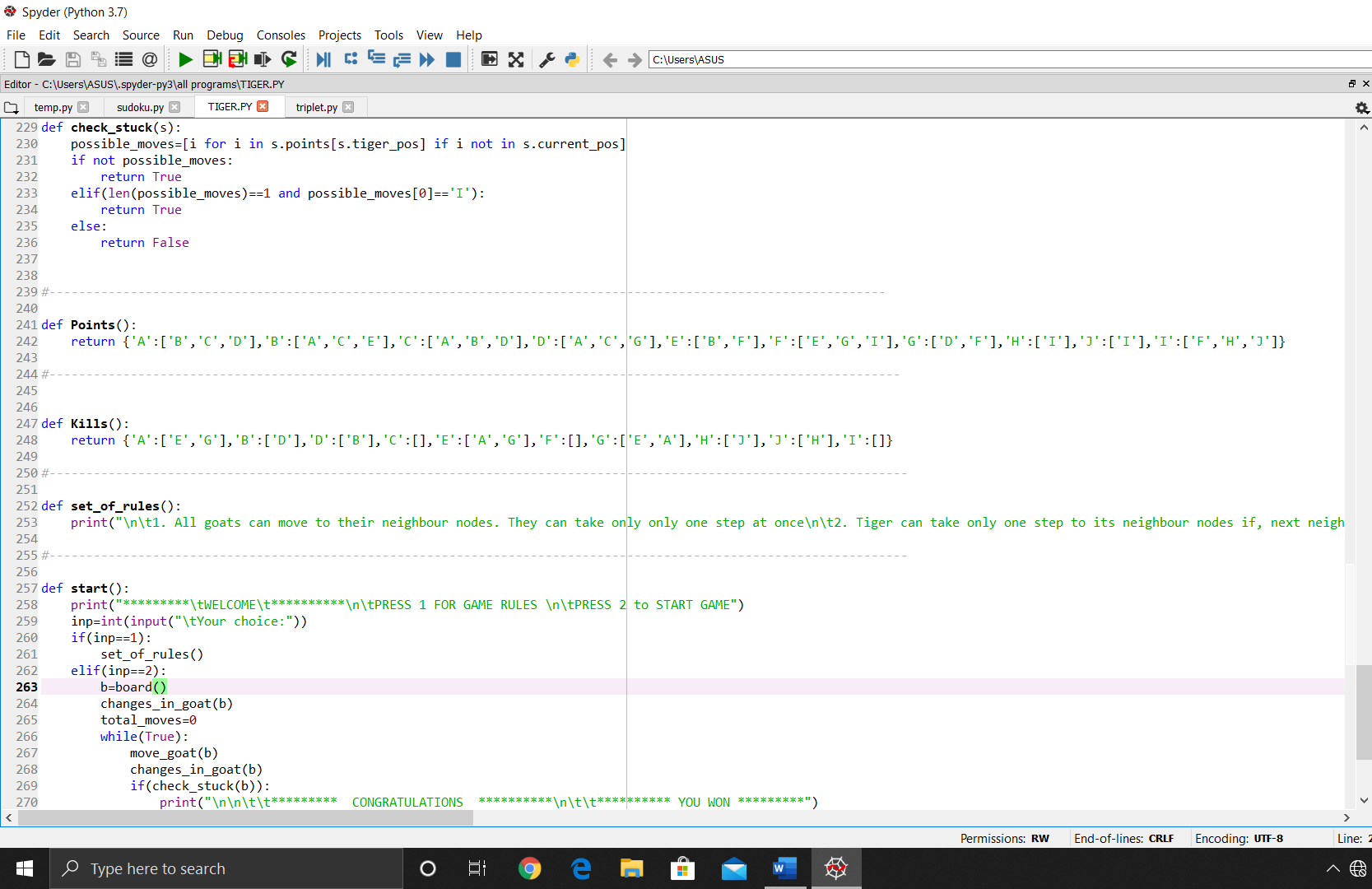
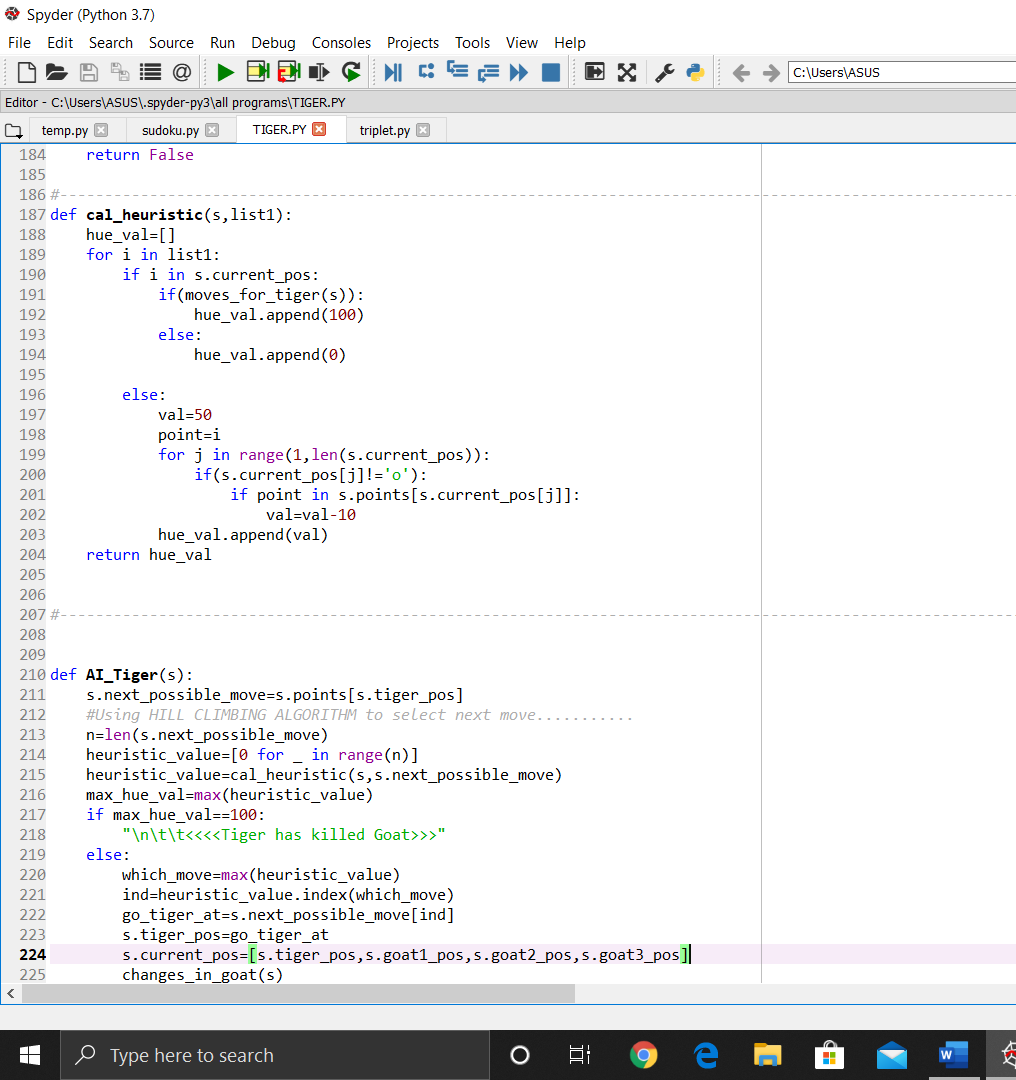
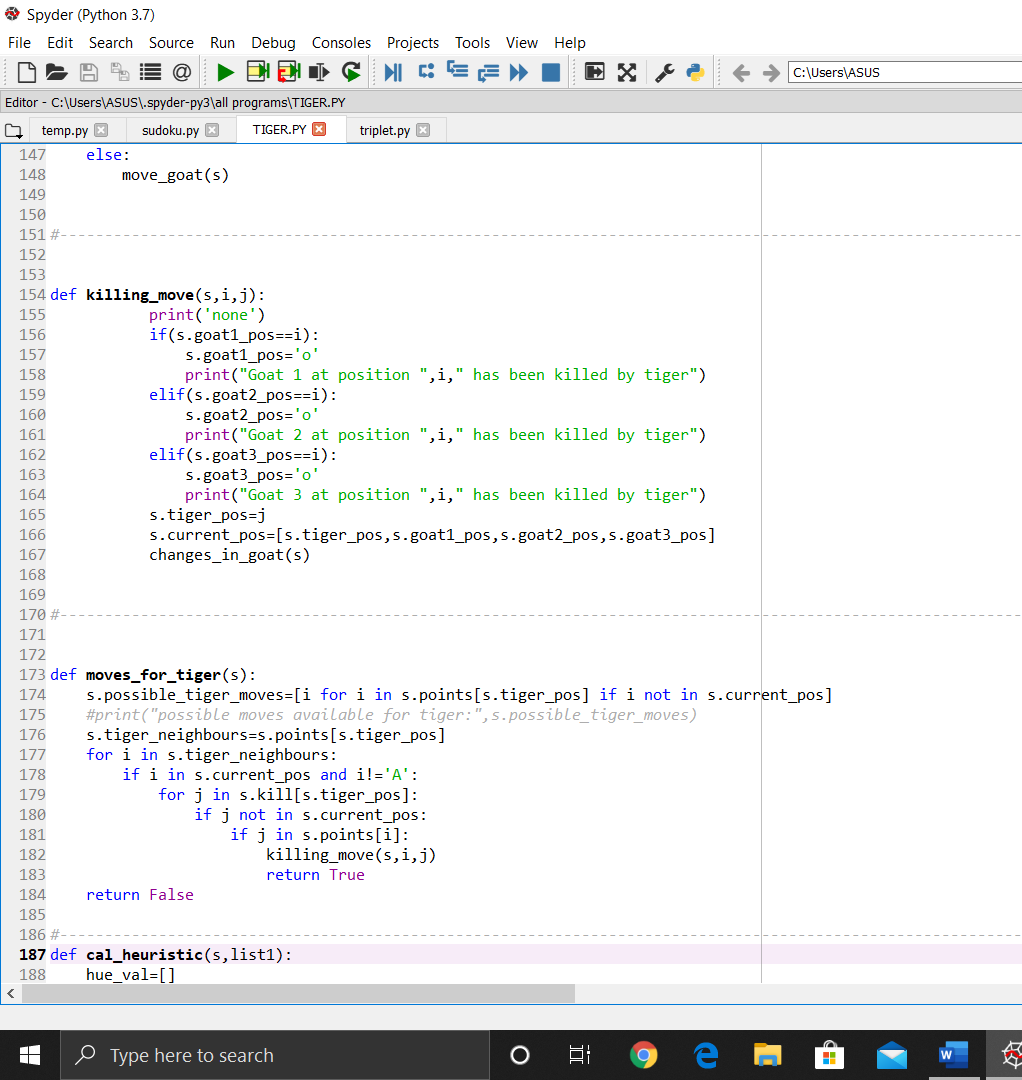
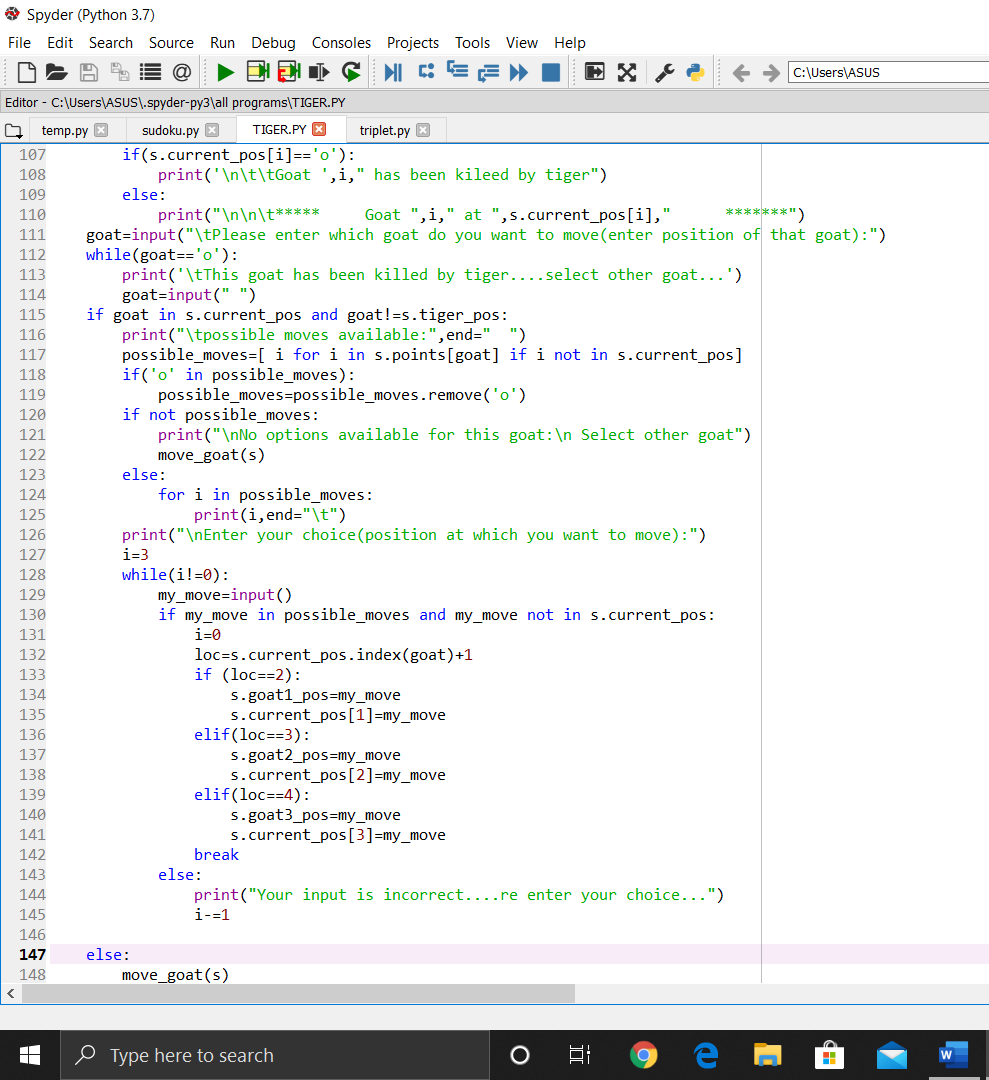
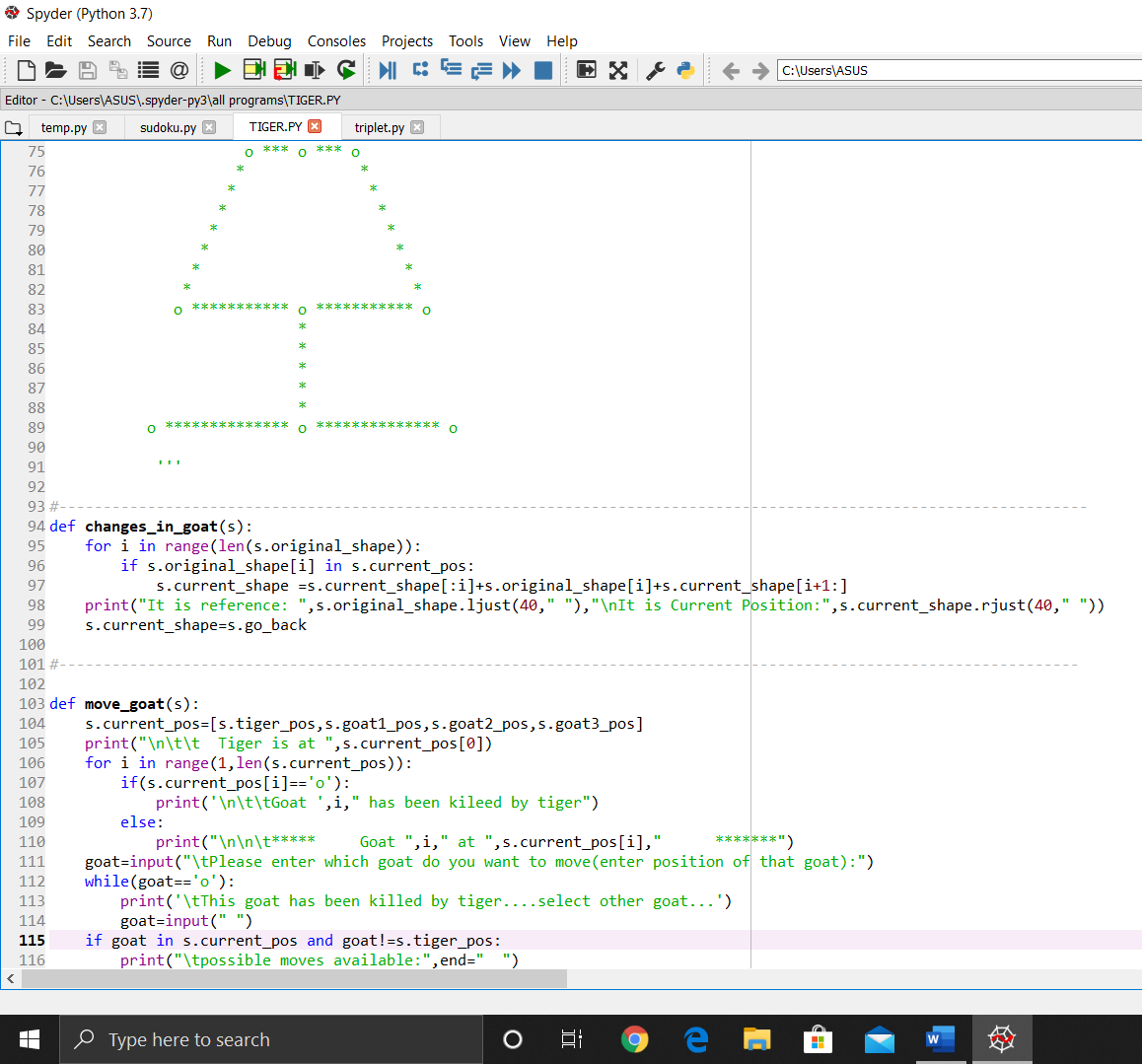
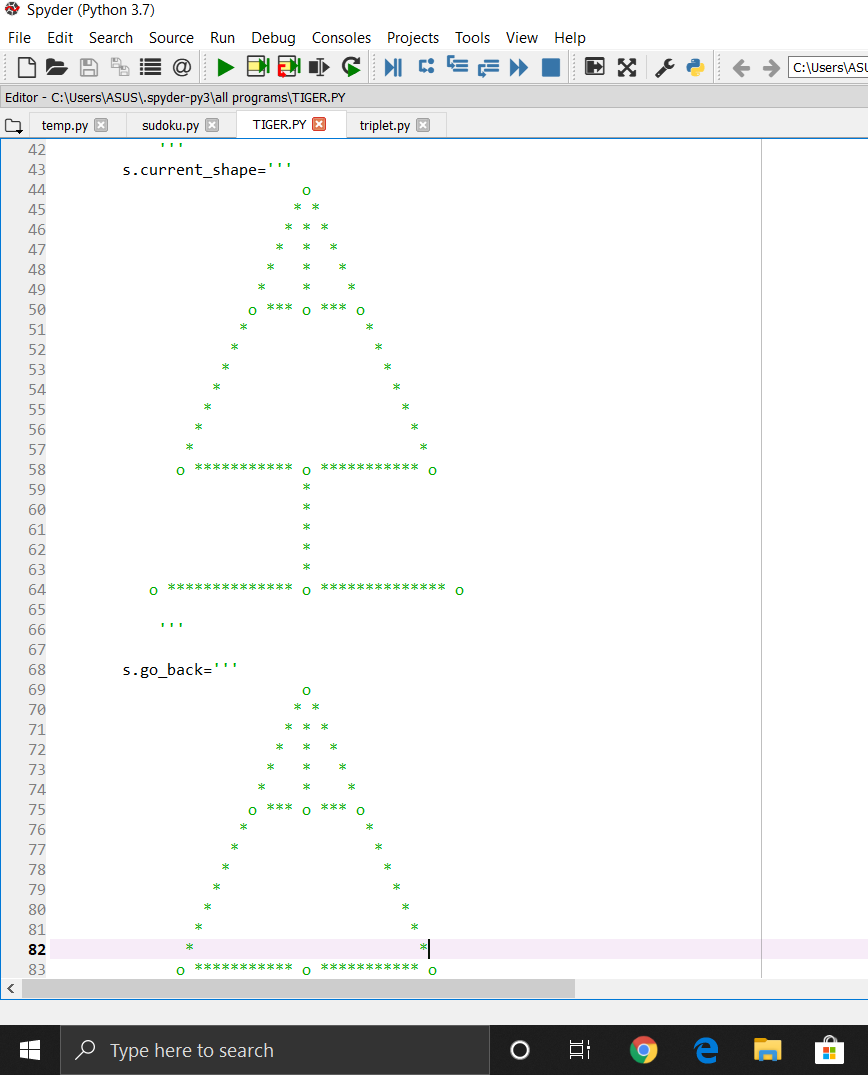
In this game knowledge is quite important unlike game of bridge. In this game proper strategy of game is required and knowledge of game is must.

1. Does the task require interaction with person or not?

As it is AI vs Human game so, it requires interaction with human as well.

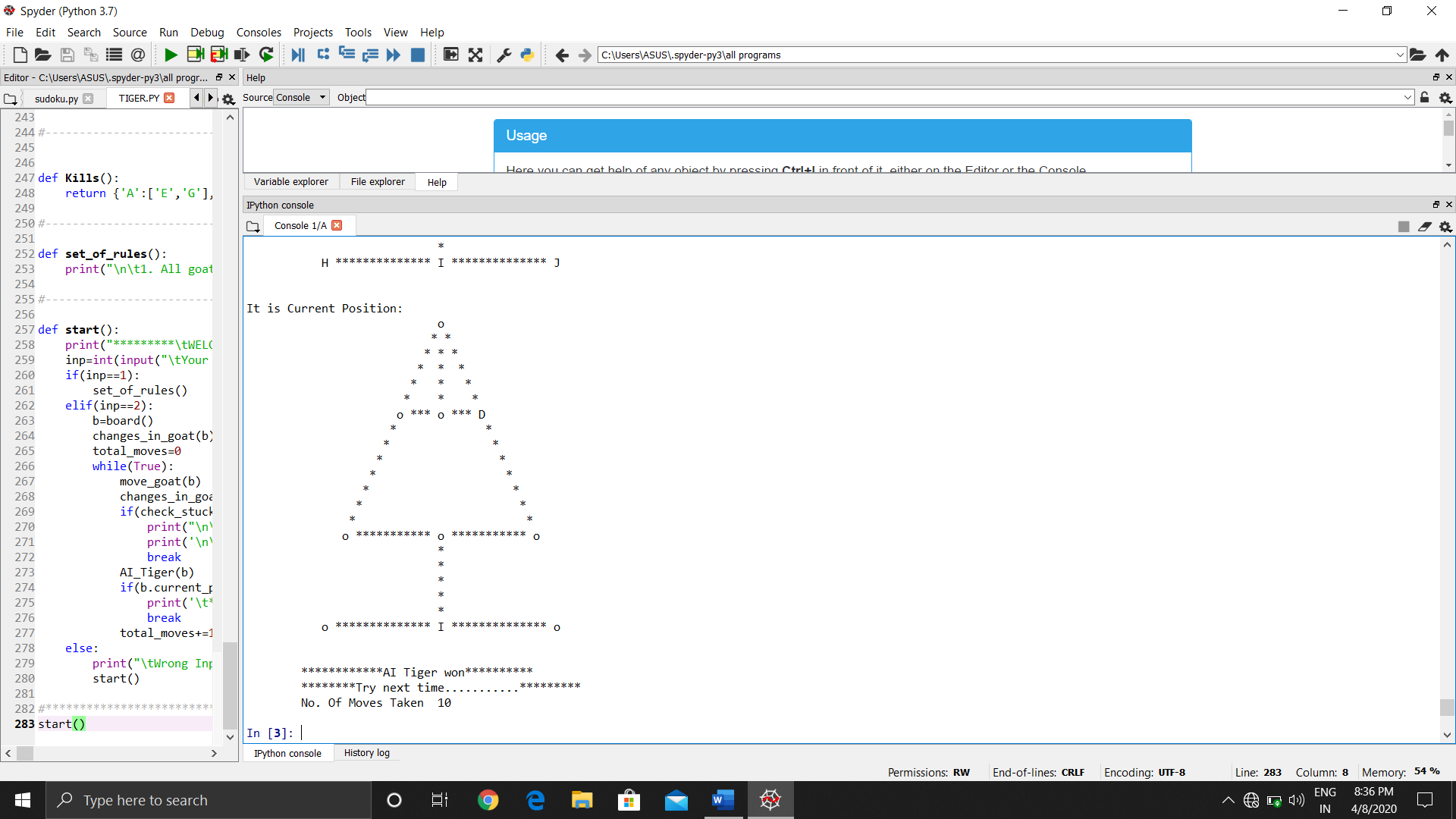
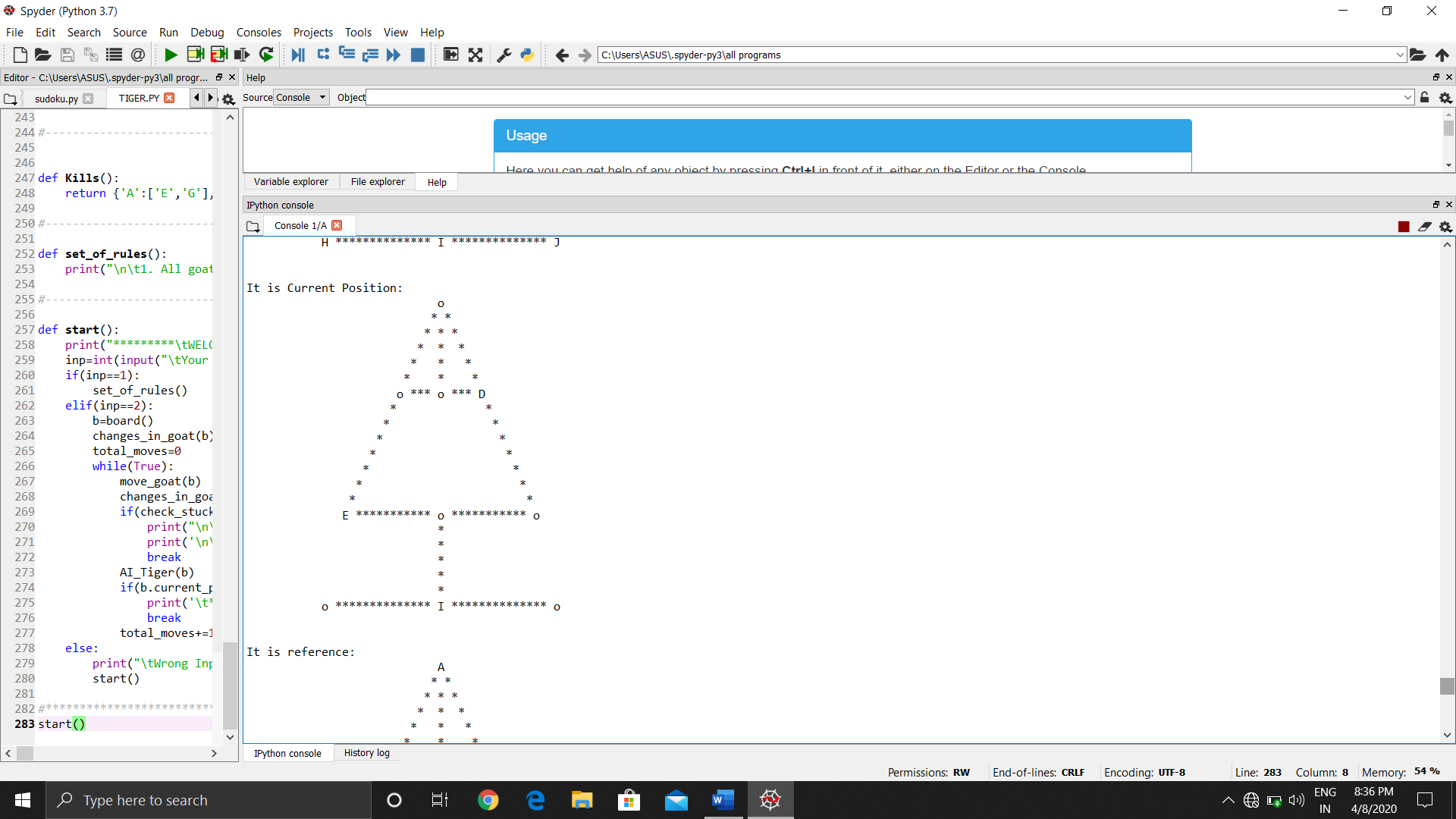
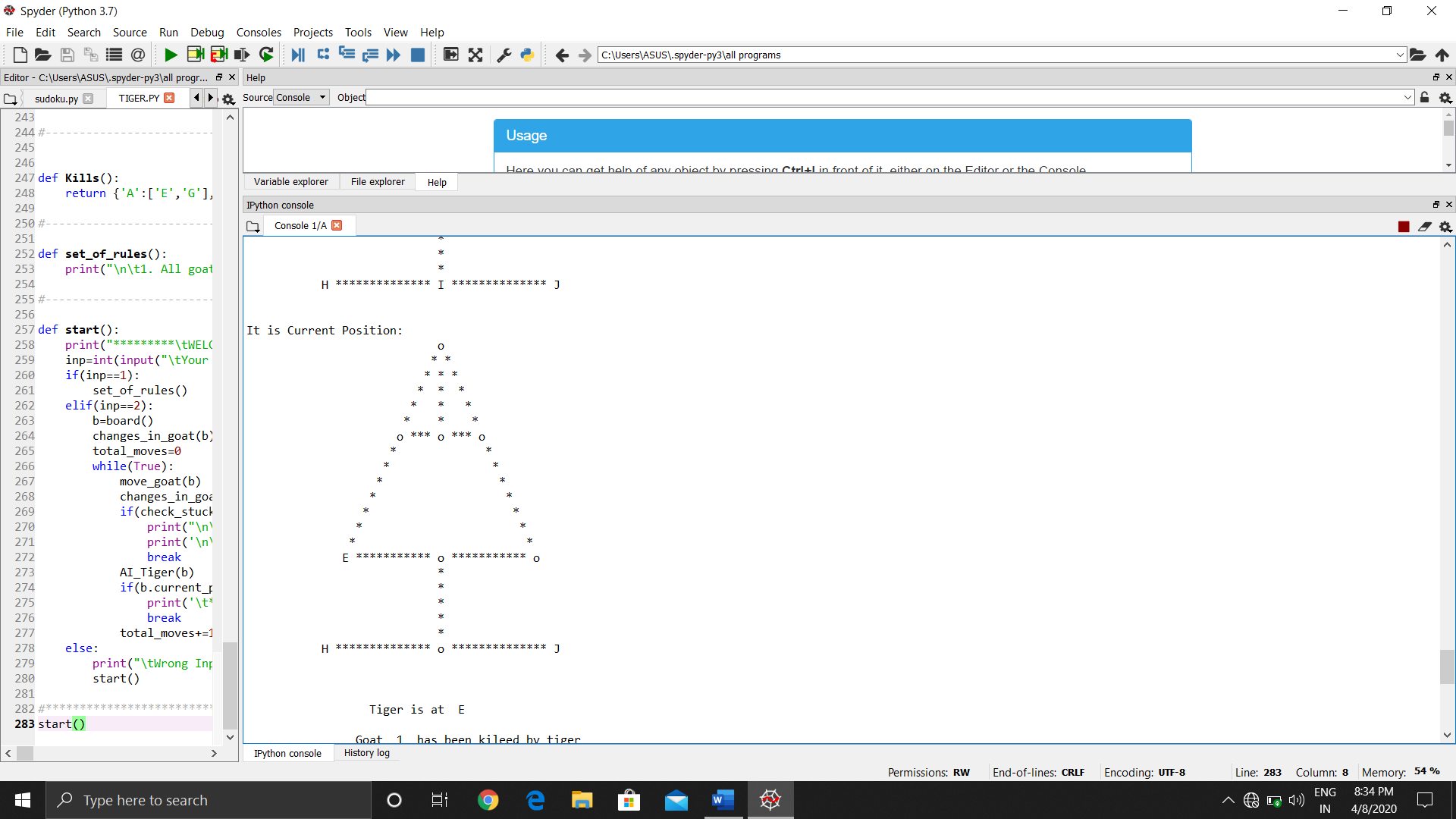
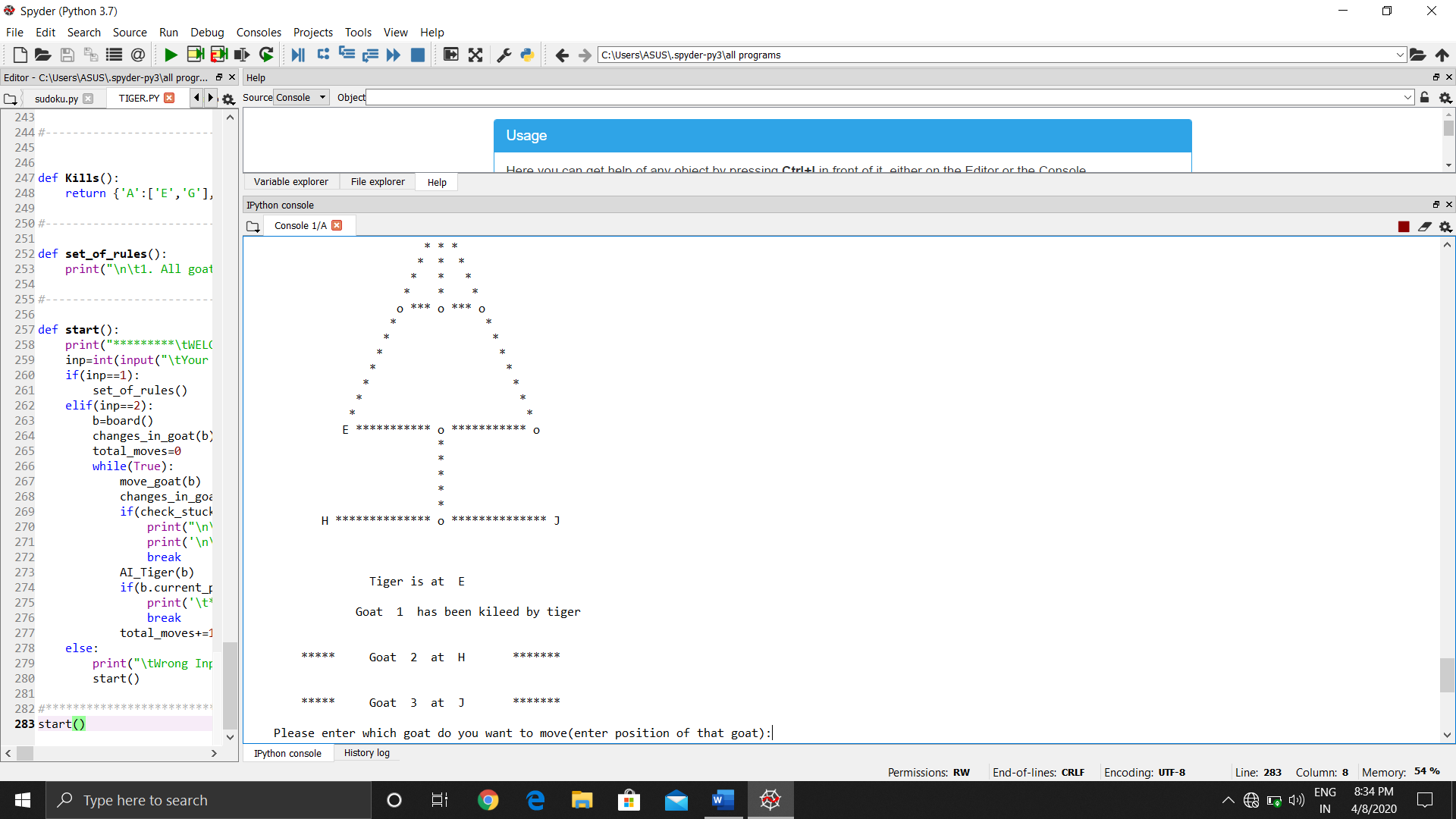
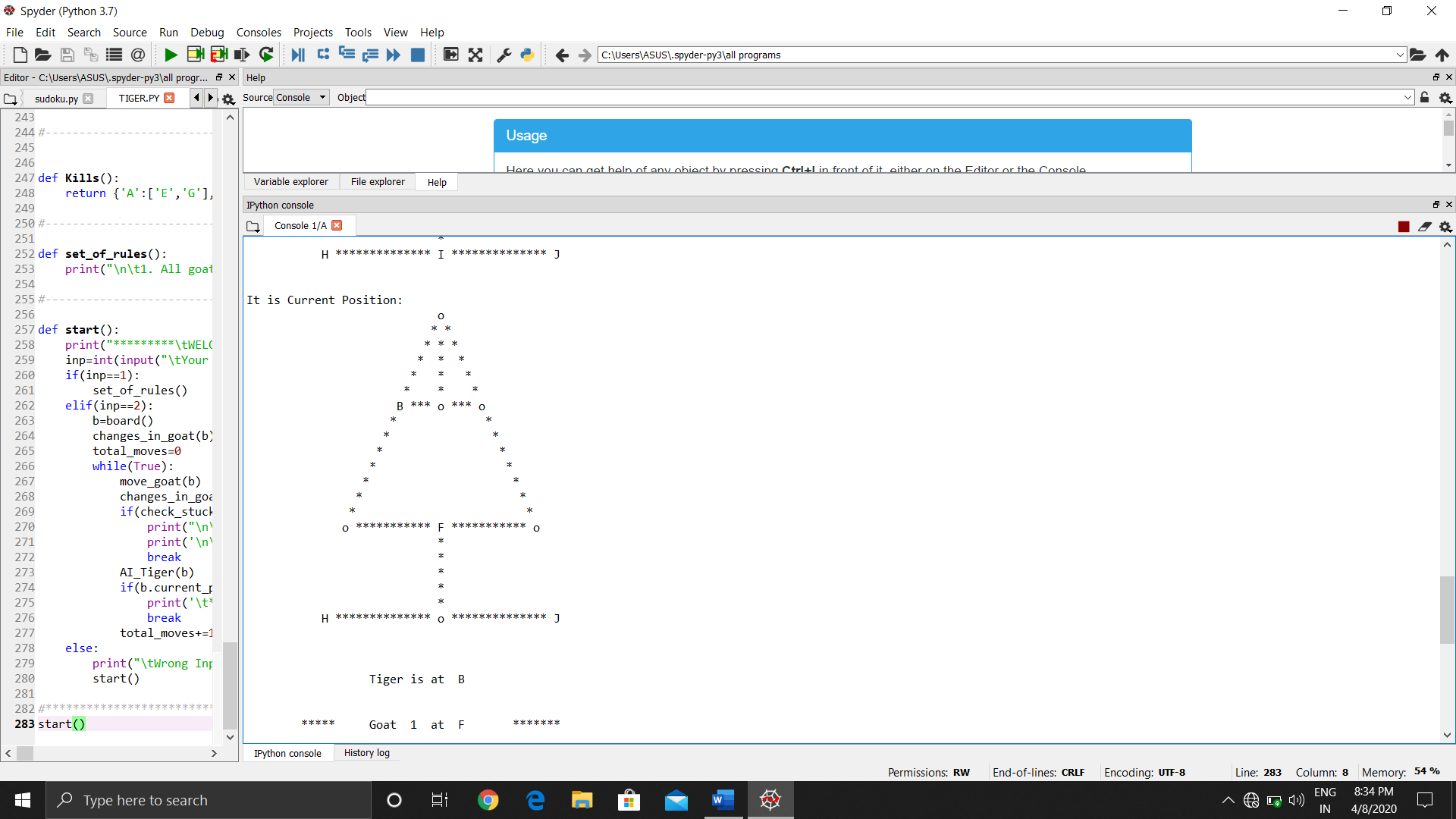
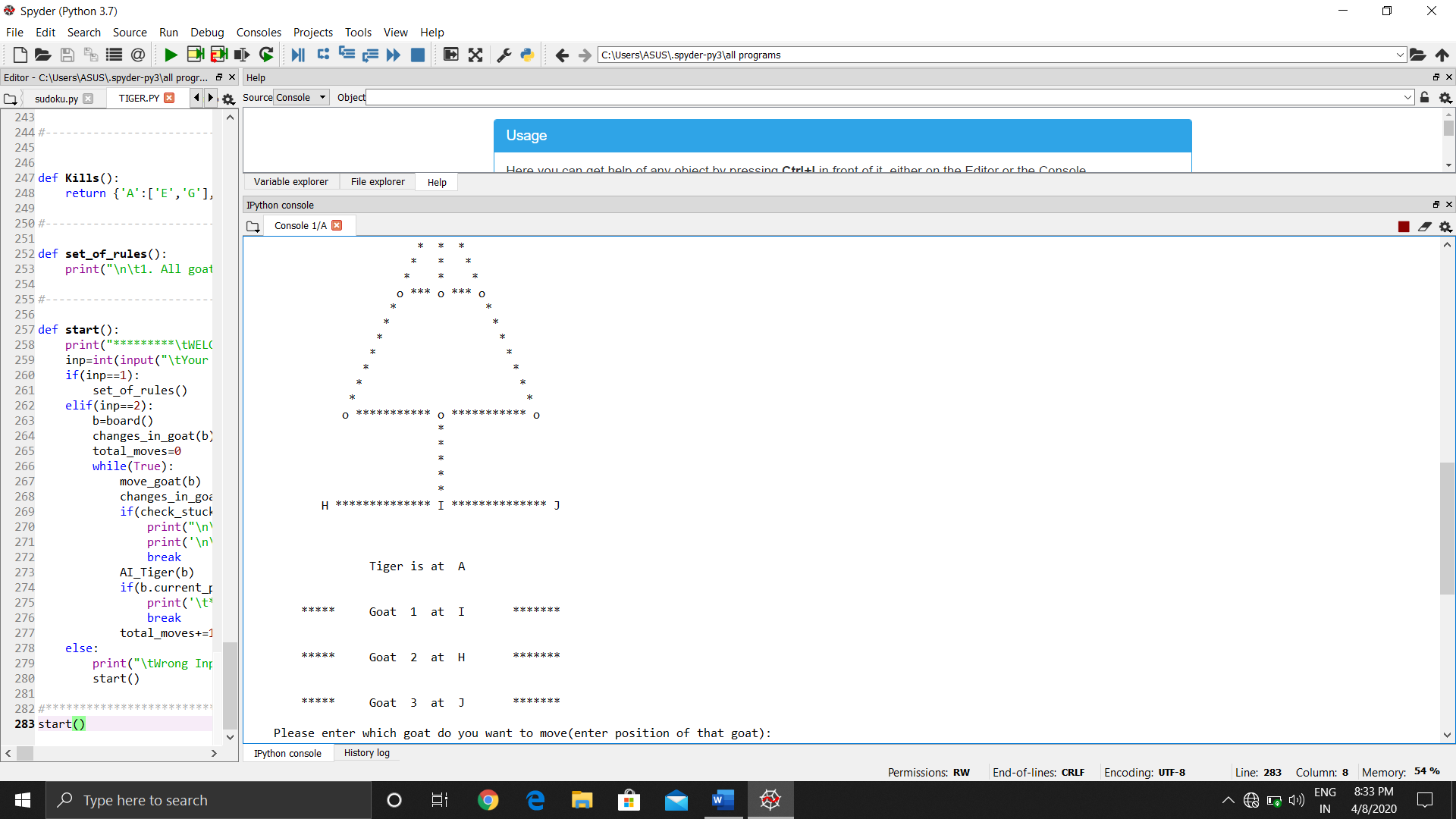
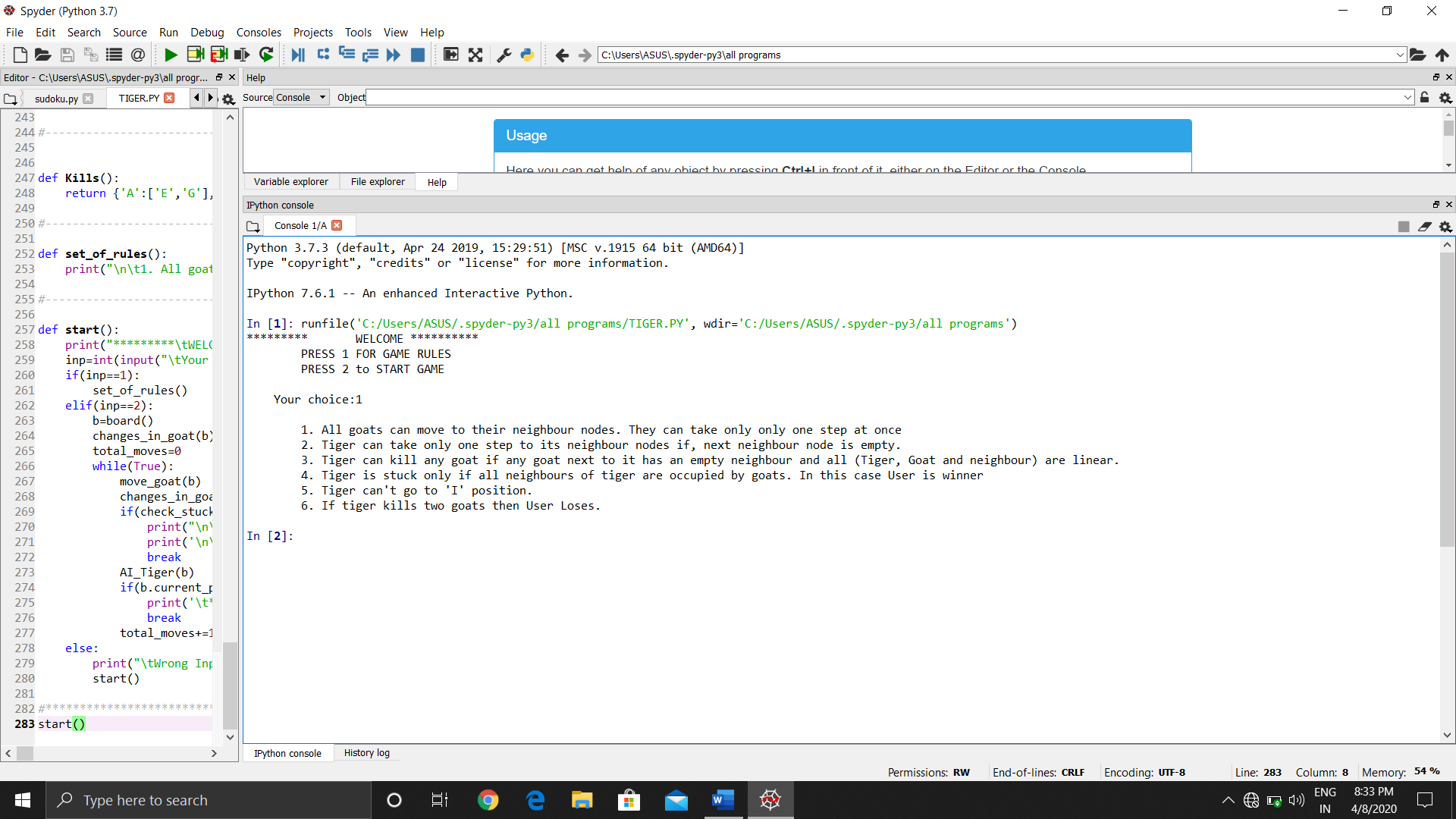
Code Screenshots

Below are the screenshots for the Tiger Goat Trap Game--



Gameplay/Output

For better understanding one can run Tiger.py file on his own systems, and try to defeat AI Tiger 😊😊

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**Sudoku**

Sudoku requires high computational thinking; it is all about eliminating those integers which do not fit into that particular box or cell. So, **Generate, Eliminate and Test** is the algorithms which fulfils its requirements. The implementation of Sudoku will be mentioned in report submitted by Mr. Venkatesh.

Link: www.github.com/venkateshrv/Sudoku

**LIBRARIES USED**

**Tiger Goat Trap Game**

No external library has been used in Tiger Goat Trap Game. Game has been developed by using standard functions.

**Sudoku**

**re library:**

re in python stands for Regular Expressions. It is used in to detect if a given regular expression matches a particular string. In sudoku game this has been used to design Sudoku board.

**deepcopy library:**

In python whenever a programmer tries to copy the string object through assignment operator, new string is not created but only reference to that string object is created. So, with the help of deepcopy module we can make a separate new object which will be copy of original object. In Sudoku game, for applying Generate and Test algorithm it is quiet useful as every time code generates a possible solution and if it is unsuccessful then the original object is still unchanged.

**REFERENCES**

In this project references have been taken from various online sites, Books to provide better functionalities to game. These are some of them below-

<https://docs.python.org/3/library/re.html>

is used to know about re module.

<https://www.w3schools.com/python/python_regex.asp>

is used to understand better practical implementations of re module and all its functions.

<https://docs.python.org/2/library/copy.html>

is used to make use of copy module in the project.

<https://www.geeksforgeeks.org/copy-python-deep-copy-shallow-copy/>

is used to understand practical implementation of copy module.

<https://youtu.be/URHZiLu1-LI>

[http://www.sudokuguy.com](https://www.youtube.com/redirect?event=video_description&v=URHZiLu1-LI&q=http%3A%2F%2Fwww.sudokuguy.com&redir_token=hx_Bli-HPCIG0TE-8NidLyiJzUR8MTU4NDEyOTE0MEAxNTg0MDQyNzQw)

are used for strategy design for Sudoku game.

THANK YOU